TEST REPORT

Applicant:	TFIVE PTY LTD
Address:	10/29 Lorne Ave Killara NSW 2071 Australia
Equipment Type:	Smart Lock U100
Model Name:	SDL-D01 (refer section 2.4)
Brand Name:	Aqara
Test Standard:	AS/NZS CISPR 32: 2015+AMD1:2020
Sample Arrival Date:	Apr. 19, 2023
Test Date:	Apr. 21, 2023 - Apr. 25, 2023
Date of Issue:	Apr. 28, 2023

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

Tested by: Xiong Chong **Checked by:** Xia Long **Approved by:** Liao Jianming (Technical Director)

Revision History

Version	Issue Date	Revisions Content
Rev. 01	Apr. 28, 2023	Initial Issue

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1 GENERAL INFORMATION

1.1 Test Laboratory

Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100

1.2 Test Location

Name	Shenzhen BALUN Technology Co., Ltd.
Location	☑ Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
	☐ 1/F, Building B, Ganghongji High-tech Intelligent Industrial Park, No. 1008, Songbai Road, Yangguang Community, Xili Sub-district, Nanshan District, Shenzhen, Guangdong Province, P. R. China

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	TFIVE PTY LTD
Address	10/29 Lorne Ave Killara NSW 2071 Australia

2.2 Manufacturer Information

Manufacturer	Lumi United Technology Co., Ltd.
Address	Room 801-804, Building 1, Chongwen Park, Nanshan iPark, No. 3370, Liuxian Avenue, Fuguang Community, Taoyuan Residential District, Nanshan District, Shenzhen, China

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 General Description for Equipment under Test (EUT)

EUT Name	Smart Lock U100
Model Name Under Test	SDL-D01
Series Model Name	DL-D01D
Description of Model name differentiation	All models are same with electrical parameters and internal circuit structure, but only differ in model name and color. (this information provided by the customer)
Hardware Version	V2.1
Software Version	1.0.4_0007
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Ancillary Equipment

Ancillary Equipment 1	Battery	
	Brand Name	PAIRDEER
	Model No.	LR6
	Serial No.	N/A
	Capacity	N/A
	Rated Voltage	1.5V
	Limit Charge Voltage	N/A

2.6 Technical Information

Network and Wireless connectivity		Bluetooth, Zigbee, NFC
Interfaces present on the EUT	AC Ports	From mains to AC power adapter.
	DC Ports	From power supply to EUT, the DC port cable length is less than 3m.
	I/O Ports	Type-C, which cable length is less than 3m.
	Telecom Ports	No Telecom Ports.

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	AS/NZS CISPR 32: 2015+AMD1:2020	Electromagnetic compatibility of multimedia equipment — Emission requirements

3.2 Verdict

No.	Base Standard	Description		Test Verdict	Result	Remark
Emission						
1	CISPR 32	Radiated Emission	Below 1 GHz	Pass	ANNEX A.1	--
			Above 1 GHz	Pass		Note 1
2	CISPR 32	Conducted Emission	Mains terminals	Pass	ANNEX A.2	--
			Asymmetric mode	N/A	ANNEX A.3	Note 2
			Differential voltage	N/A	ANNEX A.4	Note 3
Note 1: The highest frequency of the internal sources of the EUT is above 108 MHz, the measurement shall be made above 1 GHz. Note 2: For cables longer than 3 m only. Note 3: For Class B broadcasting receiver only.						

3.3 Test Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Value
Conducted emissions (9 kHz-30 MHz)-AMN	3.22 dB
Radiated emissions (30 MHz-1 GHz)-10m	4.80 dB
Radiated emissions (1 GHz-18 GHz)-966#2	4.88dB

4 GENERAL TEST CONFIGURATIONS

4.1 Test Environments, Test Date and Test Engineer

Test items	Voltage	Temperature	Relative Humidity	Ambient Pressure	Test Date	Test Engineer
Radiated Emission	USB 5V	24.3℃ 23.3℃	64% 52%	101kPa 101kPa	Apr. 21, 2023 Apr. 24, 2023	Lin Yupeng He Shichang
Conducted Emission	USB 5V	23.1℃	60%	101kPa	Apr. 25, 2023	Liang Yongming

4.2 Test Equipment

Radiated Emission Test For Frequency Below 1 GHz (10 m)						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	ROHDE&SCHWARZ	ESRP	101036	2022.09.09	2023.09.08	☒
Amplifier (30-1GHz)	COM-MV	ZT30-1000M	B2018054558	2022.12.07	2023.12.06	☒
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9168	9168-01162	2020.08.12	2023.08.11	☒
Anechoic Chamber	EMC Electronic Co., Ltd	20.10*11.60*7.35m	130	2021.08.15	2024.08.14	☒
Description	Manufacturer	Name		Version		Use
Test Software	BALUN	BL410-E		V22.930		☒

Radiated Emission Test For Frequency Above 1 GHz (3m-966#2)						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	Keysight	N9038A	MY55330120	2022.09.09	2023.09.08	☒
Amplifier (1-12GHz)	Advanced Microwave	WLA652A	1740103	2022.12.07	2023.12.06	☒
Amplifier (0.8-21GHz)	Mini-Circuits	ZVA-213-S+	225321316	2022.12.07	2023.12.06	☐
Test Antenna-Horn	SCHWARZBECK	BBHA 9120D	01917	2022.06.09	2025.06.08	☒
Anechoic Chamber	YiHeng	9m*6m*6m	142	2021.08.19	2024.08.18	☒
Description	Manufacturer	Name		Version		Use
Test Software	BALUN	BL410-E		V22.930		☒

Conducted disturbance Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	KEYSIGHT	N9010B	MY57110309	2022.09.09	2023.09.08	☒
LISN	SCHWARZBECK	NSLK 8127	8127-687	2022.06.01	2023.05.31	☒
ISN	TESEQ	ISN T800	34449	2022.11.11	2023.11.10	☐
ISN	TESEQ	ISN T8-Cat6	53561	2022.05.24	2023.05.23	☐
Shielded Room	YiHeng Electronic Co., Ltd	3.5m*3.1m*2.8m	112	2022.02.19	2025.02.18	☒
Description	Manufacturer	Name		Version		Use
Test Software	BALUN	BL410-E		V22.930		☒

4.3 Test Enclosure list

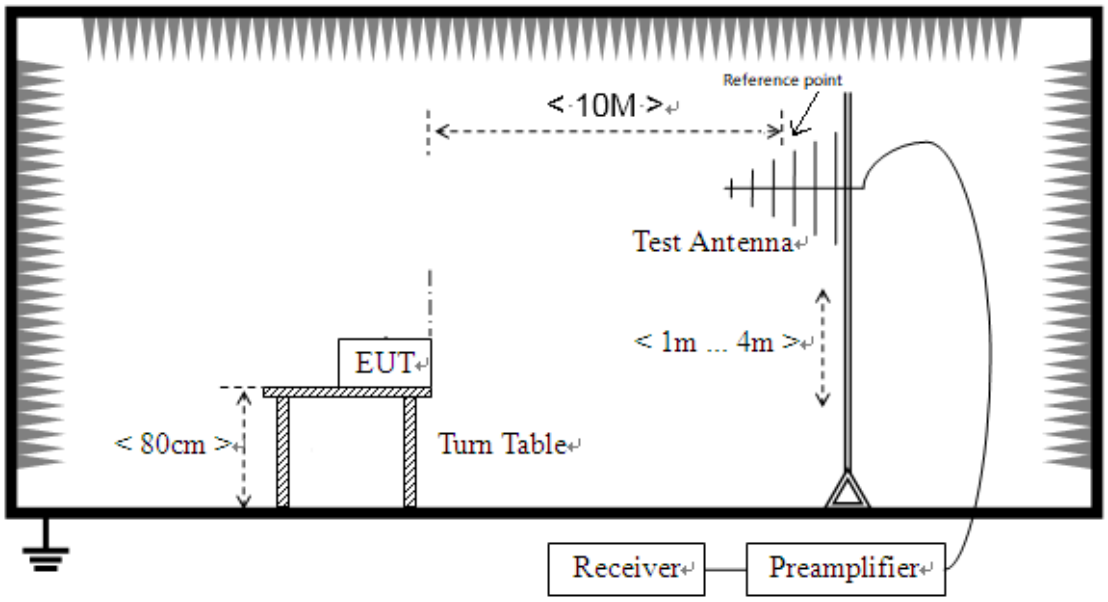
Description	Manufacturer	Model	Serial No.	Length	Description	Use
Adapter	OPPO	AK903HK	N/A	N/A	N/A	☒
Type-C Cable	N/A	N/A	N/A	1m	N/A	☒

4.4 Test Configurations

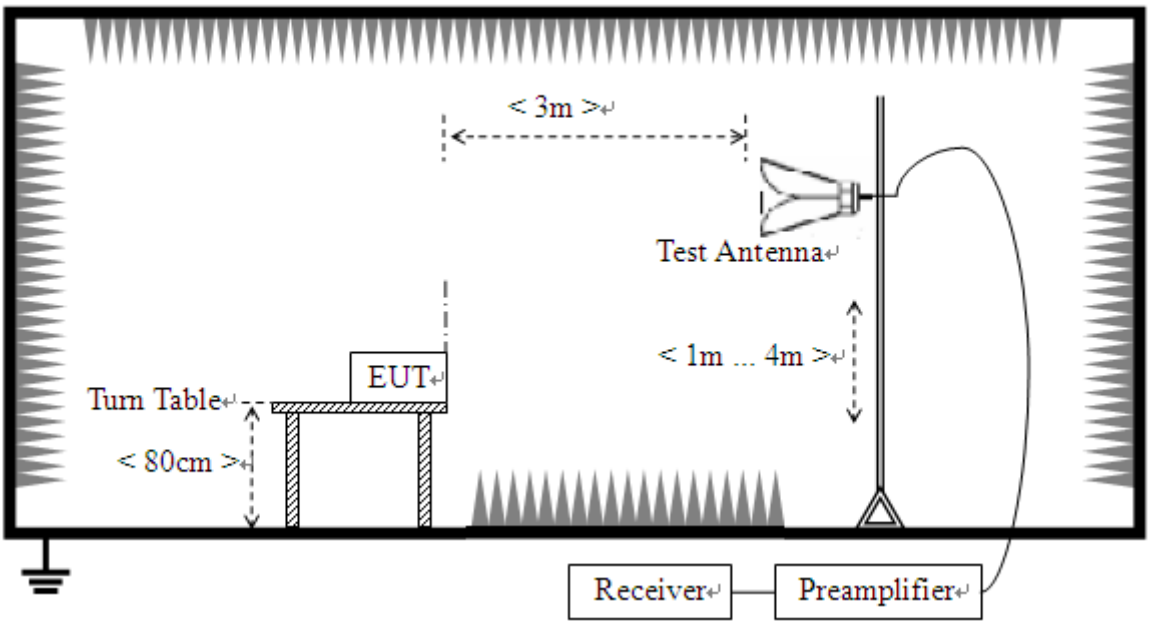
Test Configurations (TC) No.	Description
TC01	The Working Test Mode EUT + Battery + Type-C Cable + Adapter

4.5 Test Setups

Test Setup 1

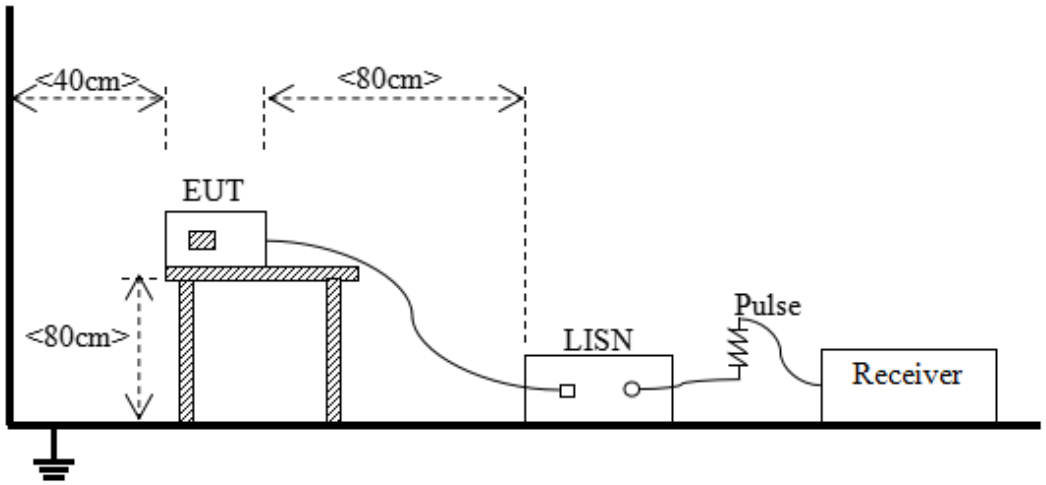


(For Radiated Emission Test (30 MHz-1 GHz))



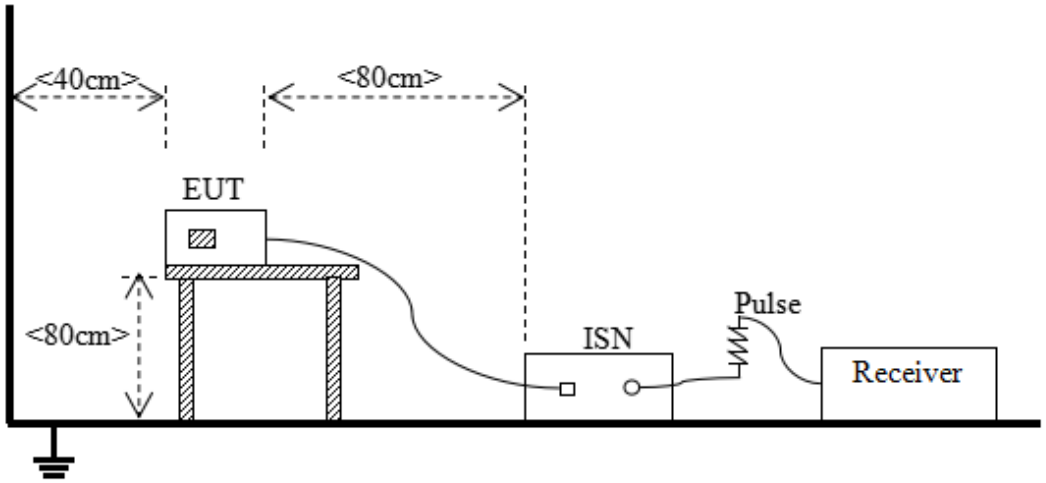
(For Radiated Emission Test (above 1 GHz))

Test Setup 2



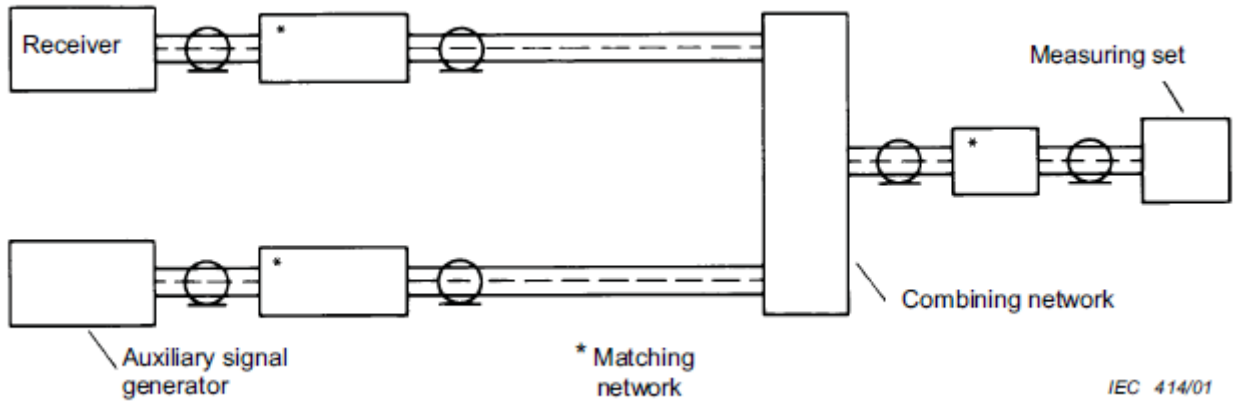
(For Conducted disturbance voltage at mains terminals Test)

Test Setup 3



(For Conducted disturbance for asymmetric mode Test)

Test Setup 4



(For Conducted differential voltage emission (TV/FM broadcast receiver tuner ports))

4.6 Test Conditions

Test Case	Test Conditions	
Radiated Emission	Test Setup	Test Setup 1
	Test Configuration	TC01 Note
Conducted disturbance voltage at mains terminals	Test Setup	Test Setup 2
	Test Configuration	TC01 Note
Note: Based on client request, all normal using modes of the normal function were tested, but only the worst test data of test mode is reported in this report. The Working Test Mode is the worst mode in this report.		

5 TEST ITEMS

5.1 Emission Tests

5.1.1 Radiated Emission

5.1.1.1 Limit

Frequency range (MHz)	Class A (10 m)	Class A (3 m)	Class B (10 m)	Class B (3 m)
	Quasi-Peak Limit (dBμV/m)		Quasi-Peak Limit (dBμV/m)	
30 - 230	40	50	30	40
230 - 1000	47	57	37	47

Frequency range (MHz)	Class A (at 3 m)		Class B (at 3 m)	
	Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)
1000-6000	80	60	74	54

Requirements for radiated emissions from FM receivers

Frequency range (MHz)	Measurement		Quasi-Peak Limit (dBμV/m) Fundamental	Quasi-Peak Limit (dBμV/m) Harmonics	Quasi-Peak Limit (dBμV/m) Other
	Facility	Distance (m)			
30-230	OATS/SAC	10	50	42	30
230-300				42	37
300-1000				46	37
30-230	OATS/SAC	3	60	52	40
230-300				52	47
300-1000				56	47

NOTE:

1) The lower limit shall apply at the transition frequency.
2) Additional provisions may be required for cases where interference occurs.

5.1.1.2 Test Setup

Please refer to 4.5 section description of test setup of test setup 1. The photo of test setup please refer to ANNEX B.

5.1.1.3 Test Procedure

An initial pre-scan was performed in the chamber using the EMI Receiver in peak detection mode. Quasi-peak measurements were conducted based on the peak sweep graph. The EUT was measured by Bi-Log antenna with 2 orthogonal polarities.

5.1.1.4 Test Result

Please refer to ANNEX A.1.

5.1.2 Conducted disturbance voltage at mains terminals

5.1.2.1 Test Limit

Frequency range (MHz)	Class A		Class B	
	Quasi-peak (dBµV)	Average (dBµV)	Quasi-peak (dBµV)	Average (dBµV)
0.15 - 0.50	79	66	66-56	56-46
0.50 - 5	73	60	56	46
5 - 30	73	60	60	50

NOTE:

1) The lower limit shall apply at the band edges.
2) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50 MHz.

5.1.2.2 Test Setup

Please refer to 4.5 section description of test setup of test setup 2. The photo of test setup please refer to ANNEX B.

5.1.2.3 Test Procedure

The EUT is connected to the power mains through a LISN which provides 50 Ω/50 µH of coupling impedance for the measuring instrument. The test frequency range is from 150 kHz to 30 MHz. The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and Average (AV) detectors; the emission levels that are more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed.

5.1.2.4 Test Result

Please refer to ANNEX A.2.

5.1.3 Conducted disturbance for asymmetric mode

5.1.3.1 Test Limit

Frequency range (MHz)	Class A		Class B	
	Quasi-peak (dBμV)	Average (dBμV)	Quasi-peak (dBμV)	Average (dBμV)
0.15 - 0.50	97-87	84-74	84-74	74-64
0.50 - 30	87	74	74	64

NOTE:

1) The lower limit shall apply at the band edges.
2) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50 MHz.

5.1.3.2 Test Setup

Please refer to 4.5 section description of test setup of test setup 3. The photo of test setup please refer to ANNEX B.

5.1.3.3 Test Procedure

Measurement of common mode (asymmetric mode) current or voltage emissions at wired network ports for attachment of unscreened balanced pairs shall be performed with the wired network port connected by a cable to an AAN. The AAN shall define the common mode termination impedance seen by the wired network port during the emission measurements.

The voltage division factor shall be added to the measured voltage measured by the receiver directly at the voltage measurement port of the AAN and the result compared with the voltage limits as applicable.

5.1.3.4 Test Result

Please refer to ANNEX A.3.

5.1.4 Conducted differential voltage emission

5.1.4.1 Test Limit

Applicability	Frequency range (MHz)	Differential voltage limit @75Ω(dBμV)		
		Local Oscillator Fundamental	Local Oscillator Harmonics	Other
Television receivers; video recorders; PC TV broadcast receiver tuner cards; Digital audio receivers	30 to 950	46	46	46
	950 to 2150	54	54	46
Tuner units (not the LNB) for satellite signal reception	950 to 2150	54	54	46
FM audio receivers and PC tuner cards	30 to 300	54	50	46
	300 to 1000	54	52	46
FM car radios	30 to 300	66	59	46
	300 to 1000	66	52	46
RF modulator output ports connect to TV broadcast receiver tuner ports	30 to 950	76	46	46
	950 to 2150	N/A	54	46

5.1.4.2 Test Setup

Please refer to 4.5 section description of test setup of test setup 4. The photo of test setup please refer to ANNEX B.

5.1.4.3 Test Procedure

1. The impedance as seen from the TV/FM broadcast receiver tuner port of the EUT shall be equal to the nominal antenna input impedance for which the port has been designed. The EUT shall be tuned to the wanted signal from the AE (signal generator). The emission level shall be measured across the relevant frequency range taking into account the attenuation between the EUT TV/FM broadcast receiver tuner port and the measurement device.

2. The RF modulator output port of the EUT is connected to the input of the measuring device by means of a coaxial cable and a matching network (if necessary). The characteristic impedance of the cable shall be equal to the nominal output impedance of the EUT. The EUT shall produce an RF carrier modulated by a video signal defined. The RF output level shall be obtained by adding the insertion loss of the matching network to the indication of the measuring device (tuned to the video carrier frequency and its harmonics).

5.1.4.4 Test Result

Please refer to ANNEX A.4.

ANNEX A TEST RESULTS

A.1 Radiated Emission

Note 1: The symbol of “--” in the table which means not application.

Note 2: Measurements shall be made with a quasi-peak measuring receiver in the frequency range 30 MHz to 1000 MHz.

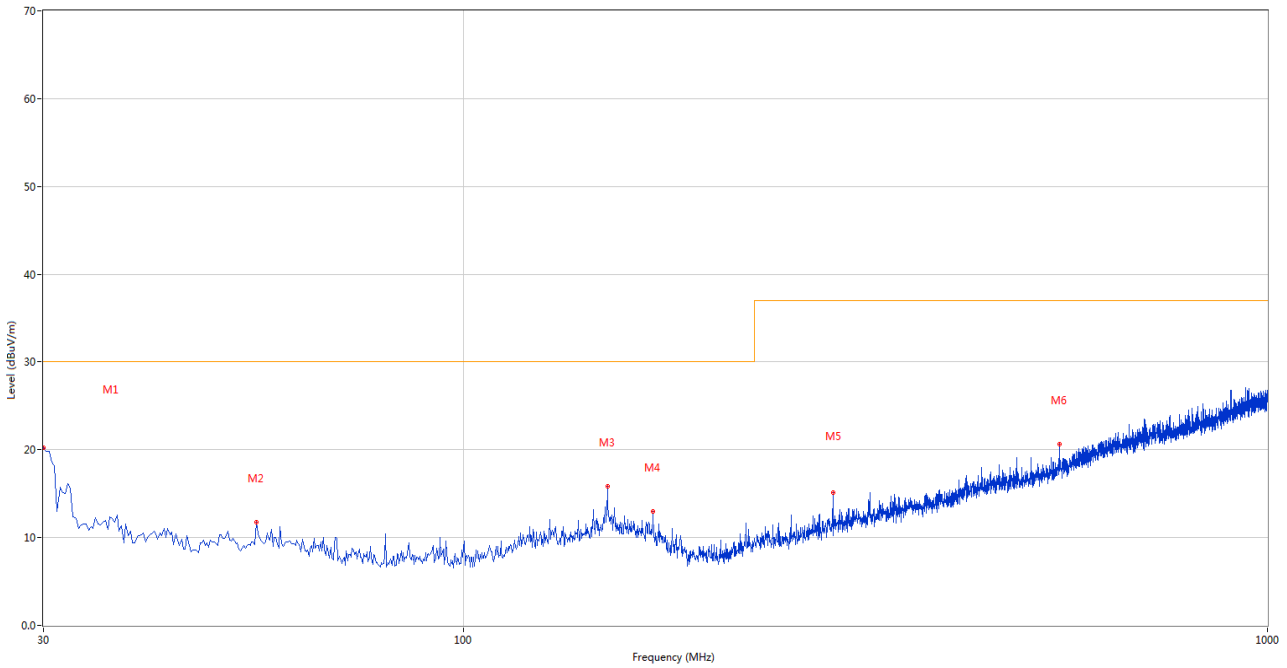
To reduce the testing time, a peak measuring receiver may be used instead of a quasi-peak measuring receiver. In case of dispute, measurement with a quasi-peak measuring receiver will take precedence.

Note 3: When the EUT is on, it will automatically emit Zigbee or Bluetooth signal and cannot be turned off. So the marked spikes near 2400 MHz with circle should be ignored because they are Zigbee or Bluetooth carrier frequencies.

Test Data and Plots (Below 1 GHz)

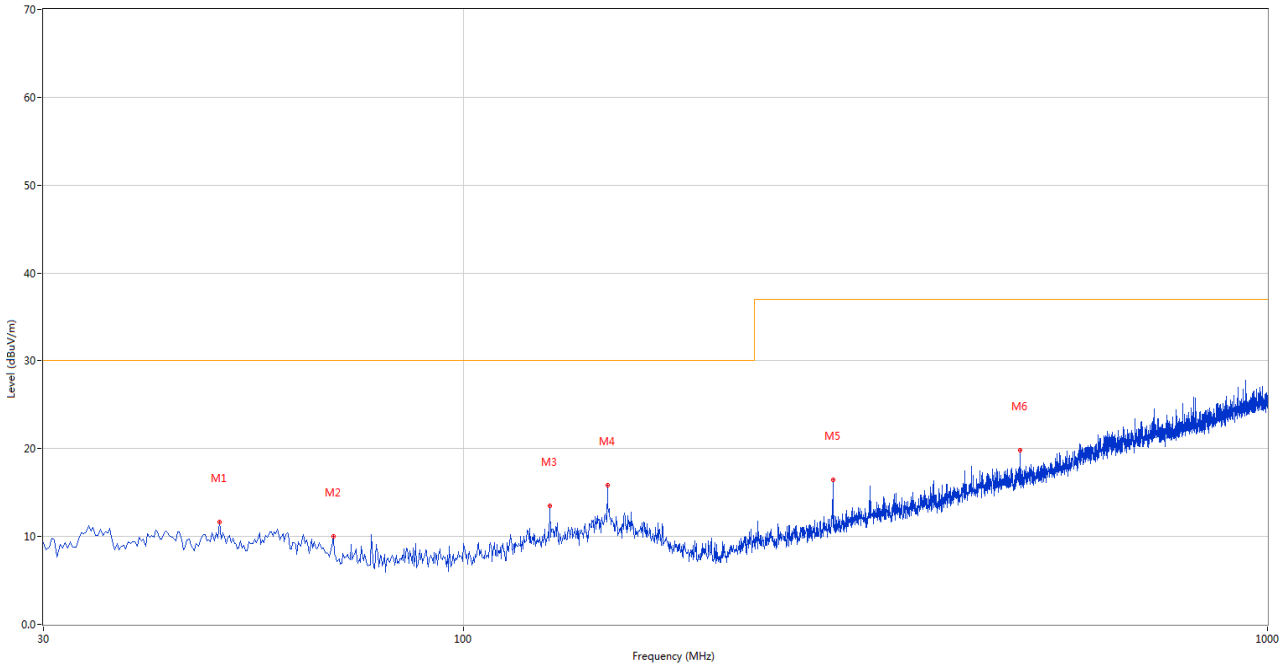
The Working Test Mode

A.1.1 Test Antenna Vertical, 30 MHz – 1 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	30.000	20.21	-27.69	30.0	9.79	Peak	241.00	100	Vertical	Pass
2	55.214	11.75	-27.38	30.0	18.25	Peak	121.00	100	Vertical	Pass
3	150.977	15.88	-25.68	30.0	14.12	Peak	217.00	200	Vertical	Pass
4	172.069	12.99	-26.71	30.0	17.01	Peak	146.00	200	Vertical	Pass
5	287.956	15.11	-25.78	37.0	21.89	Peak	247.00	100	Vertical	Pass
6	551.245	20.67	-18.92	37.0	16.33	Peak	217.00	200	Vertical	Pass

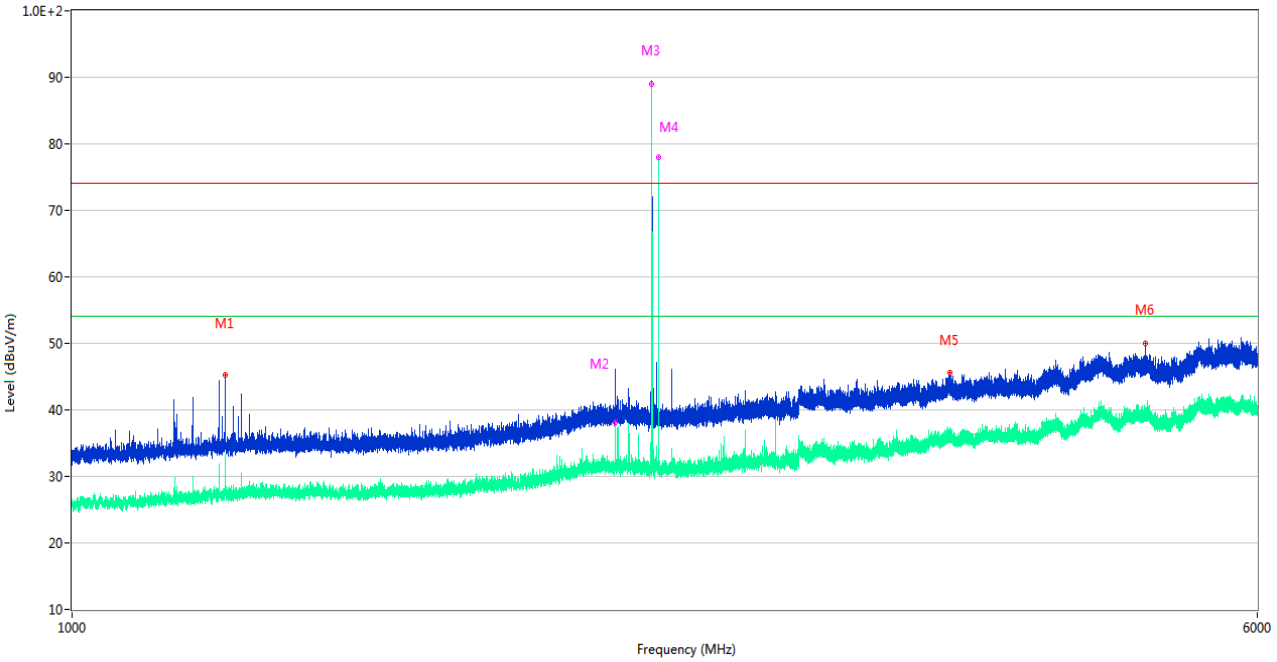
A.1.2 Test Antenna Horizontal, 30 MHz – 1 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	49.638	11.61	-27.18	30.0	18.39	Peak	0.00	200	Horizontal	Pass
2	68.790	9.99	-29.26	30.0	20.01	Peak	109.00	200	Horizontal	Pass
3	127.946	13.54	-27.37	30.0	16.46	Peak	329.00	100	Horizontal	Pass
4	150.977	15.83	-25.68	30.0	14.17	Peak	0.00	200	Horizontal	Pass
5	287.956	16.45	-25.78	37.0	20.55	Peak	187.00	200	Horizontal	Pass
6	491.847	19.79	-20.65	37.0	17.21	Peak	134.00	100	Horizontal	Pass

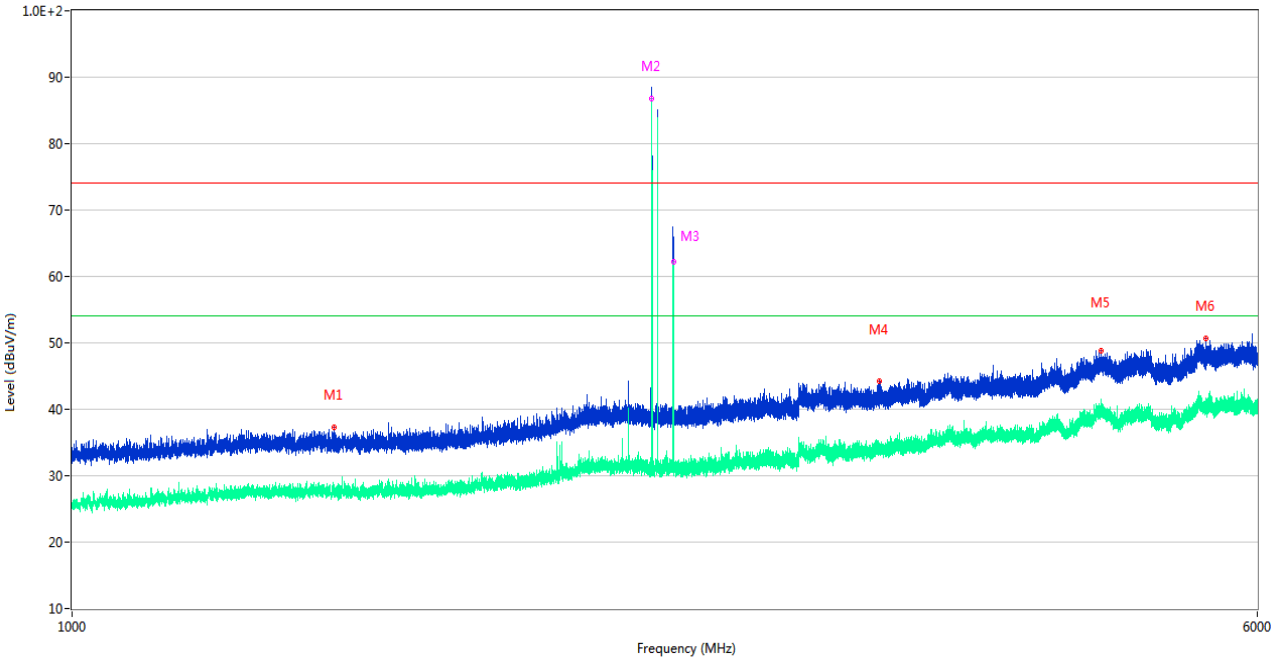
Test Data and Plots (Above 1 GHz)

A.1.3 Test Antenna Vertical, 1 GHz – 6 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1261.000	45.26	-15.74	74.0	28.74	Peak	308.00	100	Vertical	Pass
1**	1261.000	27.47	-15.74	54.0	26.53	AV	308.00	100	Vertical	Pass
2	2273.700	39.21	-11.20	74.0	34.79	Peak	182.00	100	Vertical	Pass
2**	2273.700	38.20	-11.20	54.0	15.80	AV	182.00	100	Vertical	Pass
3	2402.100	89.34	-11.76	74.0	-15.34	Peak	182.00	100	Vertical	N/A
3**	2402.100	89.05	-11.76	54.0	-35.05	AV	182.00	100	Vertical	N/A
4	2426.100	78.00	-11.62	74.0	-4.00	Peak	253.00	100	Vertical	N/A
4**	2426.100	77.98	-11.62	54.0	-23.98	AV	253.00	100	Vertical	N/A
5	3768.600	45.55	-5.62	74.0	28.45	Peak	147.00	100	Vertical	Pass
5**	3768.600	36.46	-5.62	54.0	17.54	AV	147.00	100	Vertical	Pass
6	5067.300	50.05	-2.39	74.0	23.95	Peak	125.00	100	Vertical	Pass
6**	5067.300	38.74	-2.39	54.0	15.26	AV	125.00	100	Vertical	Pass

A.1.4 Test Antenna Horizontal, 1 GHz – 6 GHz



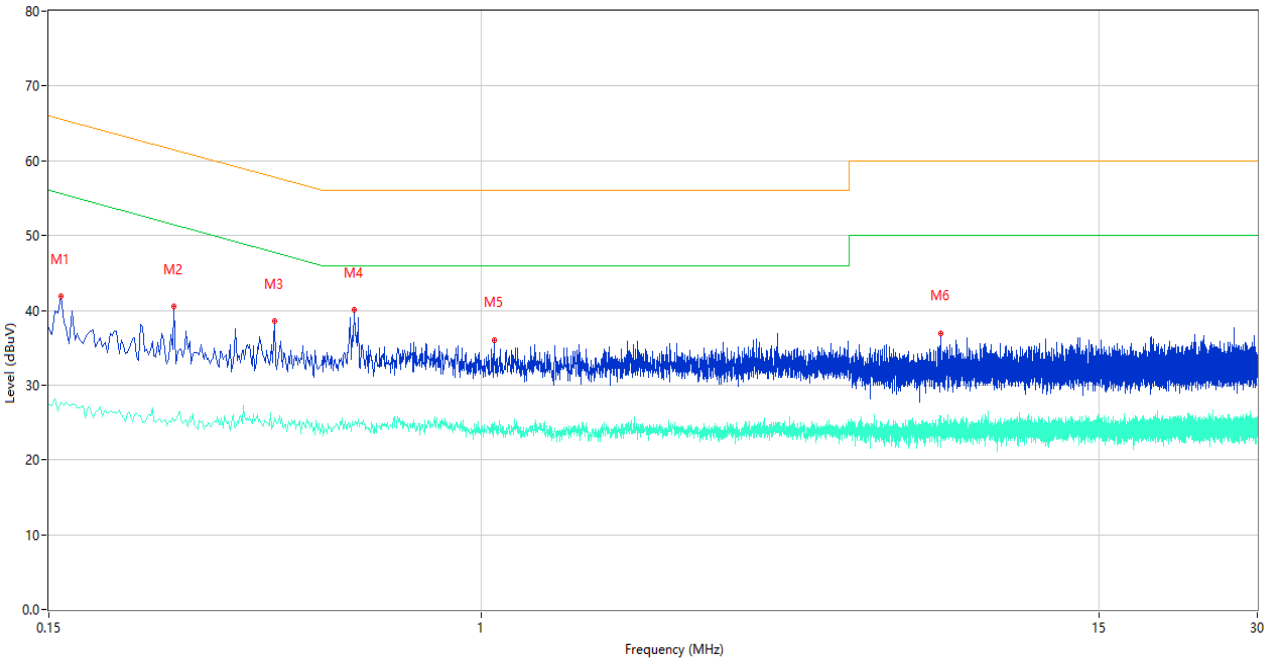
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1486.000	37.26	-16.30	74.0	36.74	Peak	263.00	100	Horizontal	Pass
1**	1486.000	27.39	-16.30	54.0	26.61	AV	263.00	100	Horizontal	Pass
2	2402.600	88.35	-11.78	74.0	-14.35	Peak	0.00	100	Horizontal	N/A
2**	2402.600	86.78	-11.78	54.0	-32.78	AV	0.00	100	Horizontal	N/A
3	2481.500	64.56	-11.19	74.0	9.44	Peak	235.00	100	Horizontal	N/A
3**	2481.500	62.28	-11.19	54.0	-8.28	AV	235.00	100	Horizontal	N/A
4	3388.200	44.26	-8.32	74.0	29.74	Peak	108.00	100	Horizontal	Pass
4**	3388.200	33.86	-8.32	54.0	20.14	AV	108.00	100	Horizontal	Pass
5	4736.700	48.87	-2.60	74.0	25.13	Peak	178.00	100	Horizontal	Pass
5**	4736.700	39.67	-2.60	54.0	14.33	AV	178.00	100	Horizontal	Pass
6	5553.450	50.62	-0.62	74.0	23.38	Peak	243.00	100	Horizontal	Pass
6**	5553.450	39.60	-0.62	54.0	14.40	AV	243.00	100	Horizontal	Pass

A.2 Conducted disturbance voltage at mains terminals Test

Test Data and Plots

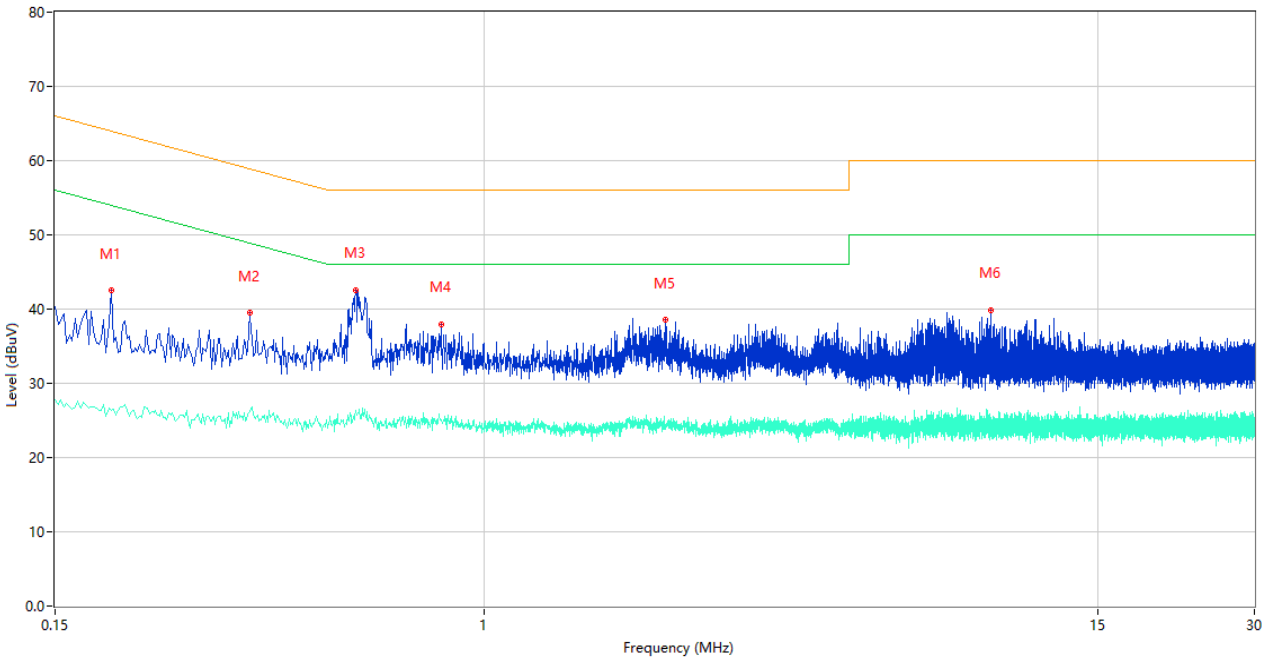
The Working Test Mode

A.2.1 L Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.158	41.85	10.08	65.57	23.72	Peak	L	Pass
1**	0.158	27.65	10.08	55.57	27.92	AV	L	Pass
2	0.260	40.55	10.01	61.43	20.88	Peak	L	Pass
2**	0.260	25.17	10.01	51.43	26.26	AV	L	Pass
3	0.404	38.58	10.72	57.77	19.19	Peak	L	Pass
3**	0.404	25.67	10.72	47.77	22.10	AV	L	Pass
4	0.572	40.01	10.27	56.00	15.99	Peak	L	Pass
4**	0.572	24.70	10.27	46.00	21.30	AV	L	Pass
5	1.056	36.06	10.26	56.00	19.94	Peak	L	Pass
5**	1.056	25.05	10.26	46.00	20.95	AV	L	Pass
6	7.484	36.96	10.50	60.00	23.04	Peak	L	Pass
6**	7.484	25.57	10.50	50.00	24.43	AV	L	Pass

A.2.2 N Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.192	42.51	10.06	63.95	21.44	Peak	N	Pass
1**	0.192	26.33	10.06	53.95	27.62	AV	N	Pass
2	0.354	39.48	10.95	58.87	19.39	Peak	N	Pass
2**	0.354	26.15	10.95	48.87	22.72	AV	N	Pass
3	0.566	42.58	10.25	56.00	13.42	Peak	N	Pass
3**	0.566	26.28	10.25	46.00	19.72	AV	N	Pass
4	0.826	37.99	10.71	56.00	18.01	Peak	N	Pass
4**	0.826	25.15	10.71	46.00	20.85	AV	N	Pass
5	2.226	38.53	10.14	56.00	17.47	Peak	N	Pass
5**	2.226	24.51	10.14	46.00	21.49	AV	N	Pass
6	9.368	39.91	10.18	60.00	20.09	Peak	N	Pass
6**	9.368	25.23	10.18	50.00	24.77	AV	N	Pass

A.3 Conducted disturbance for asymmetric mode

Note: Not applicable.

A.4 Conducted differential voltage emission

Note: Not applicable.

ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ2340760-AE-1.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ2340760-AW.PDF”.

ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL-SZ2340760-AI.PDF”.

Statement

1. The laboratory guarantees the scientificity, accuracy and impartiality of the test, and is responsible for all the information in the report, except the information provided by the customer. The customer is responsible for the impact of the information provided on the validity of the results.
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